

# Denbighshire County Council Investigation into the January 2021 Floods Flood Investigation Report



# Contents

- Executive Summary .....**
- 1 Introduction .....**
- 1.2 Purpose of the Investigation .....**
- 1.3 Legislative Context .....**
- 2.0 The Flooding Locations .....**
- 2.1 Main River Flooding .....**
  - 2.1.1 Ruthin.....
  - 2.1.2 Brookhouse, Denbigh .....
  - 2.1.3 Llandyrnog .....
  - 2.1.4 Pentre Llanrhaeadr .....
  - 2.1.5 Loggerheads .....
  - 2.1.6 Llanarmon yn Iâl .....
  - 2.1.7 Corwen.....
  - 2.1.8 Rhuddlan.....
- 2.2 Surface Water/Ordinary Watercourse flooding .....**
  - 2.2.1 Bodelwyddan .....
  - 2.2.2 Cyffylliog/Bontuchel .....
  - 2.2.3 Denbigh Green .....
  - 2.2.4 Dyserth.....
  - 2.2.5 Gwyddelwern .....
  - 2.2.6 Llanfair Dyffryn Clwyd .....
  - 2.2.7 Llangollen.....
  - 2.2.8 Nantglyn.....
  - 2.2.9 Prestatyn.....
  - 2.2.10 Meliden .....
  - 2.2.11 Rhyl.....
  - 2.2.12 St Asaph .....
  - 2.2.13 Prion.....
  - 2.2.14 Llanrhaeadr.....
- 3 Summary of Recommendations .....**

## **Executive Summary**

Between 18<sup>th</sup> and 20<sup>th</sup> January 2021, Storm Christoph brought strong winds, heavy rain and snow, with the most intense rainfall occurring over North Wales and northern England, bringing localised flooding to many areas. The Met Office reported that 50 to 100mm of rain fell widely across Wales and north-west England, with over 100mm across upland areas of Wales.

Denbighshire experienced the effects of this Storm, with heavy and prolonged rain flooding around 67 homes and 6 businesses on the 20<sup>th</sup> January. The majority of the flooding was from main river sources. Natural Resources Wales, as the relevant flood risk management authority for main rivers, has carried out its own flood investigations. Natural Resources Wales' flood investigation reports are included as appendices to this overarching investigation report.

The main communities affected by the Storm were Ruthin, Denbigh (Brookhouse), Llanrhaeadr, Llandyrnog, Llanynys, Dyserth, St.Asaph and Llanfair D.C. High river levels caused flooding of properties at Ruthin and Denbigh (Brookhouse), with a small number of isolated properties being flooded at Llanarmon yn Iâl, Rhuddlan, Loggerheads, Llanrhaeadr and Llandyrnog. Surface water and ordinary watercourse flooding also affected numerous locations across the County, with properties flooded at Llanynys, Corwen, Llanfair DC, Dyserth, St Asaph.

# 1 Introduction

## 1.1 Background to the Flood Event

Storm Christoph brought exceptionally wet weather to North Wales from 18th to 20th January and was one of the wettest 3-day periods on record.

Figure 1 below shows area-average daily rainfall totals across north-west England and North Wales from September 2020 to January 2021. This region experienced three consecutive very wet days from 18 to 20 January with area-average rainfall totals of 18.2mm, 35.7mm and 25.5mm – overall 79.4mm making this provisionally the wettest 3-day period on record for this region in a series from 1891 – marginally wetter than 3 to 5 December 2015 (78.2mm) – the latter including the record-breaking rainfall from storm Desmond. (Met Office, 2021).

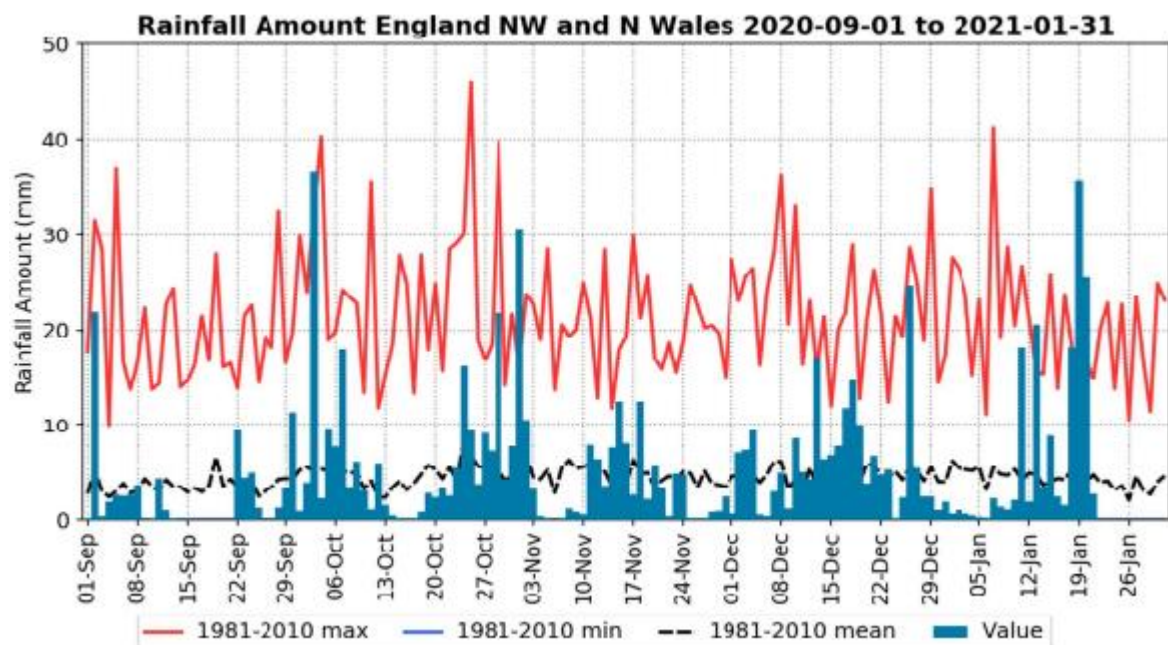


Figure 1: Area-average daily rainfall totals across north-west England and North Wales from September 2020 to January 2021 (Met Office, 2021)

It is in this context that the flooding that affected communities in Denbighshire on 20th January must be viewed. For example, Ruthin recorded 76.4 mm of rain over the four days from 18th to 21st January, which is more than the long-term monthly average for that Month (*Natural Resource Wales, 2021*).

## **1.2 Purpose of the Investigation**

The purpose of this investigation report is to address the following key questions:

- Why did the flooding happen?
- How likely it is for that scale of flooding to happen again?
- What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?

## **1.3 Legislative Context**

Denbighshire County Council, as a Lead Local Flood Authority, has a duty under Section 19 of the Flood and Water Management Act to investigate flooding in its area.

The Act states:

- (1) On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate:
  - (a) which risk management authorities have relevant flood risk management functions, and
  - (b) whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood
- (2) Where an authority carries out an investigation under subsection (1) it must:
  - (a) publish the results of its investigation, and
  - (b) notify any relevant risk management authorities.

The main sources of flooding during the January 2021 event were the River Clwyd River Ystrad and River Alyn. These are classified as main rivers and the responsibility for the detailed investigation of each flood location rests with Natural Resources Wales. There were five separate locations affected by main river flooding. These ranged from large communities, such as Ruthin and Denbigh (Brookhouse), to individual isolated properties within the Llandyrnog, Llanrheadr and Llanarmon yn Iâl Communities.

There was also some localised surface water flooding experienced at Llanynys, Llanfair D.C, St.Asaph, Bodelwyddan and Dyserth Communities, with the latter Community also experiencing flooding from the section of ordinary watercourse Known as Afon Ffyddion . The responsibility for the investigation of these events rests with Denbighshire County Council as the Lead Local Flood Authority.

## **2 The Flooding Locations**

There were more than fifteen flood locations across the county. For the purposes of this report, the flooding details for each location have been arranged by flood source, that is, main river and surface water/watercourse flooding.

### **2.1 Main River flooding**

#### **2.1.1 Ruthin**

An Investigation carried out by Natural Resources Wales has identified that the River Clwyd overtopped its banks, causing flooding of 22 residential/commercial properties at Mill Street & Clwyd Street. A single property at Maes Ffynnon was also flooded.

Because the River Clwyd is a main river, the responsibility to investigate the flooding at Ruthin lies with Natural Resources Wales. A copy of its Flood Investigation Report for Ruthin can be found as an appendix to this report.

Considering the three key questions to be addressed by the investigation:

#### **Why did the flooding happen?**

Storm Christoph brought several days of rain to the UK between 18<sup>th</sup> and 21<sup>st</sup> January 2021. Natural Resource Wales' Brynhyfryd rain gauge recorded 76.4 mm of rain over four days, which is more than the long-term monthly average. As a consequence, levels in the River Clwyd through Ruthin (recorded at Pont Howkin gauging station) began to rise steadily from around midnight on 18th January, peaking at 7:30 pm on 20<sup>th</sup> January. This caused the River Clwyd to overtop the Cae Ddol flood defence embankment, flooding areas of Mill Street and Clwyd Street. In addition, the areas around Maes Ffynnon estate and Park Place/Mwrog Street were also affected by floodwater from the River Clwyd.

#### **How likely it is for that scale of flooding to happen again?**

Natural Resources Wales is currently reviewing the standard of protection provided by its flood defences at Ruthin. As a temporary measure, Natural Resources Wales has used sand bags to increase the height of the Cae Ddol embankment to a level which should provide an increased standard of protection for properties on Mill Street and Clwyd Street.

#### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

In its report, Natural Resources Wales makes the following recommendations:

Recommendation 1.1 - Review performance of the Ruthin flood alleviation scheme using the new survey data to update the existing flood hydrological model for Ruthin. This will also allow a look at the impacts of climate change.

Recommendation 1.2 – Use the new survey information of defence crest levels to check current flood warning thresholds / trigger levels.

Recommendation 1.3 – If required, following the modelling, Natural Resources Wales should undertake an initial assessment to identify ways to further reduce the risk of flooding through Ruthin and/or improve the standard of protection of flooding from the River Clwyd

Recommendation 1.4 - Natural Resources Wales and DCC to work together to improve community engagement, giving consideration to a possible Community Flood Plan, and the establishment of a Flood Partnership Group.

Recommendation 1.5 – Natural Resources Wales to consider developing a flood forecasting model for Ruthin.

### **2.1.2 Brookhouse, Denbigh**

The investigation carried out by Natural Resource Wales has identified that the River Ystrad overtopped its banks, causing flooding of up to 8 properties (5 confirmed, 3 suspected) at Brookhouse Terrace. A copy of the flood investigation report can be found as an appendix to this report.

Considering the three key questions to be addressed by the investigation:

#### **Why did the flooding happen?**

The flooding was caused by the River Ystrad overtopping its banks, although this was not directly as a result of the prolonged rain, since the actual amount of rainfall for this area was modest, but coupled with heavily saturated conditions within the Ystrad catchment, this resulted in notable flooding impacts to the residents of Brookhouse.

#### **How likely it is for that scale of flooding to happen again?**

There is insufficient information available to determine the precise scale of the event. However, Natural Resources Wales's flood map shows that the properties would flood in a 1 in 100 chance event.

#### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

The Flood Investigation Report carried out following flooding on 9th Feb 2020 made several proposals. To date no progress has been made in considering/actioning these. Natural Resources Wales' 2021 addendum report does not propose additional actions to those recommended in 2020, but the following observations are made:

**09/02/2020 Proposal: “NRW to consider the viability of the implementation of a river level monitoring site on the Afon Ystrad to assist in earlier warning issued to residents.”**

- Consideration of the ability to provide improved warning and informing to residents, allowing additional time to prepare for flooding, could provide significant betterment at this location.

**09/02/2020 Proposal: “NRW to review the hydraulic modelling to take into account the findings of this 2020 flood investigation report.”**

- Whilst including up to date hydrological and topographical datasets will increase confidence in the understanding of risk to the community of Brookhouse, this will most likely confirm the existing understanding and mechanisms of flooding. Consideration of improved warning and informing services to the community may result in more timely provision of service improvements at this location.

### **2.1.3 Llandyrnog**

Two isolated properties were affected when the River Clwyd overtopped its banks. One property had individual property protection, but given the scale of the event, it wasn't effective in preventing extensive internal flooding.

Considering the three key questions to be addressed by the investigation:

#### **Why did the flooding happen?**

The flooding was caused by heavy, prolonged rainfall falling on saturated ground which resulted in the River Clwyd overtopping its banks at multiple locations.

#### **How likely it is for that scale of flooding to happen again?**

Whilst no information is available regarding the severity of the flood event at this location, rainfall levels were some of the highest recorded in the Clwyd catchment for this time of year, therefore the likelihood of that scale of flooding happening again is low. The River Clwyd has no formal flood defences at this location, which means that a flood could occur with less than a 1 in 100 chance.

#### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

It is unlikely that formal flood defences would be cost effective to defend a small number of isolated properties, which already have individual property protection installed. Natural Resources Wales continues to have discussions with affected residents regarding measures that can be carried out to reduce the risk and impacts of flooding. In addition, the Council is in discussions with residents regarding possible improvements to highway drainage in the area.

### **2.1.4 Pentre Llanrhaeadr**



Two properties were flooded from the River Nant Mawr, which over-topped its banks due to the heavy prolonged rain from the 18<sup>th</sup> to 20<sup>th</sup> January. However, one of the properties also suffered from surface water flooding from the public highway.

Considering the three key questions to be addressed by the investigation:

### **Why did the flooding happen?**

The flooding occurred due to the River Nant Mawr overtopping its banks following three days of heavy and prolonged rain.

Flooding to one property, located adjacent to the river in the village itself was possibly exacerbated by blockages in the river channel. A second property was also affected by the over-topping of the River Nant Mawr, and in addition suffered surface water flooding from the public highway.

### **How likely it is for that scale of flooding to happen again?**

No detailed information is available, however rain gauge data suggests that this was an extreme rainfall event, so the likelihood of this scale of flooding happening again at this location is statistically low.

### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

It might be possible to reduce flood risk by locally raising the height of the river bank adjacent to the first property referred to above. This work would require consent from Natural Resources Wales. It is also recommended that vegetation maintenance is considered, which might improve the capacity of the channel.

Carry out a survey of the river channel upstream and downstream of the flood location to check for any blockages / channel restrictions that may impact upon flow capacity.

Denbighshire County Council are to investigate possibility of carrying out a highway drainage improvement scheme to reduce the risk of surface water flooding.

## **2.1.5 Loggerheads**

Considering the three key questions to be addressed by the investigation:

### **Why did the flooding happen?**

Flooding occurred due to the River Alyn overtopping its banks following three days of heavy rain.

### **How likely it is for that scale of flooding to happen again?**

No detailed information is available, however rain gauge data suggests that this was an extreme rainfall event, so the likelihood of this scale of flooding happening again at this location is statistically low.

**What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

Natural Resources Wales should work with Denbighshire County Council Countryside Services section to investigate possible measures to reduce flood risk during extreme rainfall events.

**2.1.6 Llanarmon yn lâl**

Considering the three key questions to be addressed by the investigation:

**Why did the flooding happen?**

Flooding occurred due to the River Alyn overtopping its banks following three days of heavy rain.

**How likely it is for that scale of flooding to happen again?**

No detailed information is available, however rain gauge data suggests that this was an extreme rainfall event, so the likelihood of this scale of flooding happening again at this location is statistically low.

**What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

Natural Resources Wales should investigate whether improvement measures can be put in place to reduce flood risk during extreme rainfall events.

**2.1.7 Corwen**

Considering the three key questions to be addressed by the investigation:

**Why did the flooding happen?**

A single property flooded as a consequence of the River Dee overtopping its banks following prolonged heavy rainfall.

**How likely it is for that scale of flooding to happen again?**

No detailed information is available, however rain gauge data suggests that this was an extreme rainfall event, so the likelihood of this scale of flooding happening again at this location is statistically low.

## **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

Natural Resources Wales should investigate whether improvement measures can be put in place to reduce flood risk during extreme rainfall events.

### **2.1.8 Rhuddlan**

Considering the three key questions to be addressed by the investigation:

#### **Why did the flooding happen?**

The local watercourse and surface water drainage system in the vicinity of Pont Robin, Rhuddlan, became overwhelmed following a prolonged period of heavy rainfall, leading to flooding of a single property.

#### **How likely it is for that scale of flooding to happen again?**

No detailed information is available, however rain gauge data suggests that this was an extreme rainfall event, so the likelihood of this scale of flooding happening again at this location is statistically low.

#### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

It is recommended that Natural Resources Wales investigates whether improvements can be made to the main river watercourse at Pont Robin to improve capacity during extreme rainfall events.

## **2.2 Surface Water/Ordinary Watercourse Flooding**

### **2.2.1 Bodelwyddan**

#### **Why did the flooding happen?**

Watercourses to the south of Tyn y Borth crossroads, A547 (Rhuddlan Road) became overwhelmed due to prolonged heavy rainfall, leading to flooding of three properties.

#### **How likely it is for that scale of flooding to happen again?**

No detailed information is available, however rain gauge data suggests that this was an extreme rainfall event, so the likelihood of this scale of flooding happening again at this location is statistically low.

#### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

The drainage system in the area comprises a main river, ordinary watercourses and highway drainage. A solution to reduce flood risk is likely to be difficult to achieve, given the complex interactions between the various systems during extreme rainfall events. Nevertheless, it is recommended that Natural Resources Wales and Denbighshire County Council work together with landowners to investigate whether improvements can be made.

### **2.2.2 Cyffylliog/Bontuchel**

#### **Why did the flooding happen?**

At Bontuchel, one property flooded as a consequence of a culvert which became blocked due to debris being carried downstream during heavy rainfall. In Cyffylliog, a property was affected by groundwater flooding, again due to prolonged heavy rainfall.

#### **How likely it is for that scale of flooding to happen again?**

The risk of flooding due to blockages that occur due to debris being carried downstream during extreme rainfall events is difficult to determine. There is no recorded history of groundwater flooding at Cyffylliog. The future likelihood of groundwater flooding is also difficult to determine.

#### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

Denbighshire County Council should investigate whether measures can be put in place to reduce the risk of a culvert blockage. The owner of the Cyffylliog property has been provided with advice regarding possible measures to reduce the likelihood and impacts of groundwater flooding.

### **2.2.3 Denbigh Green**

#### **Why did the flooding happen?**

A single property was flooded from the public highway due to extremely heavy rainfall which overwhelmed the highway drainage system. It is possible that a partial blockage of the drainage system occurred during the rainfall event.

#### **How likely it is for that scale of flooding to happen again?**

Highway drainage systems are designed to deal with heavy rainfall, but there will always be a possibility that they will be overwhelmed during an extreme rainfall event.

#### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

The highway gullies have been checked and cleaned. There are no recommended improvement actions at this location.

#### **2.2.4 Dyserth**

##### **Why did the flooding happen?**

In total, seven properties flooded at Dyserth; five due to the Afon Ffyddion overtopping its banks and flood defences, and two due to surface water. The flooding occurred following a prolonged period of heavy rainfall.

##### **How likely it is for that scale of flooding to happen again?**

No detailed information is available, however rain gauge data suggests that this was an extreme rainfall event, so the likelihood of this scale of flooding happening again at this location is statistically low.

##### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

Denbighshire County Council is in the process of developing a flood risk management scheme for Dyserth, which will reduce the likelihood of flooding during a similar rainfall event.

#### **2.2.5 Gwyddelwern**

##### **Why did the flooding happen?**

A single property was flooded due to surface water runoff from the Public highway during a period of exceptionally heavy rainfall.

##### **How likely it is for that scale of flooding to happen again?**

Highway drainage systems are designed to deal with heavy rainfall, but there will always be a possibility that they will be overwhelmed during an extreme rainfall event.

##### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

Denbighshire County Council will investigate whether improvements can be made to the highway drainage system to reduce the risk of flooding in future.

#### **2.2.6 Llanfair Dyffryn Clwyd**

##### **Why did the flooding happen?**

Three properties were flooded when surface water ran off adjacent farmland during a period of prolonged heavy rainfall.

**How likely it is for that scale of flooding to happen again?**

No detailed information is available, however rain gauge data suggests that this was an extreme rainfall event, so the likelihood of this scale of flooding happening again at this location is statistically low.

**What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

Denbighshire County Council commissioned a flood risk assessment and has included this location in a project to assess how a natural flood management approach can be used to manage and reduce flood risk.

**2.2.7 Llangollen**

**Why did the flooding happen?**

A single property was flooded due to surface water runoff from the Public highway during a period of exceptionally heavy rainfall.

**How likely it is for that scale of flooding to happen again?**

Highway drainage systems are designed to deal with heavy rainfall, but there will always be a possibility that they will be overwhelmed during an extreme rainfall event.

**What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

Denbighshire County Council will investigate whether improvements can be made to the highway drainage system to reduce the risk of flooding in future.

**2.2.8 Nantglyn**

**Why did the flooding happen?**

A single property was flooded from multiple surface water sources during a period of exceptionally heavy rainfall.

**How likely it is for that scale of flooding to happen again?**

No detailed information is available, however rain gauge data suggests that this was an extreme rainfall event, so the likelihood of this scale of flooding happening again at this location is statistically low.

### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

Denbighshire County Council has carried out a flood risk assessment and has secured Welsh Government grant funding to carry out repairs and improvements to the existing drainage infrastructure.

#### **2.2.9 Prestatyn**

##### **Why did the flooding happen?**

A single property was affected by a localised surface water problem during a period of exceptionally heavy rainfall.

##### **How likely it is for that scale of flooding to happen again?**

This was an isolated incident and it is impossible to accurately determine the likelihood of a similar event happening again.

### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

The property owner has carried out measures to reduce flood risk in future.

#### **2.2.10 Meliden**

##### **Why did the flooding happen?**

Two properties were flooded due to a combination of surface water and the main river overtopping its banks.

##### **How likely it is for that scale of flooding to happen again?**

No detailed information is available, however rain gauge data suggests that this was an extreme rainfall event, so the likelihood of this scale of flooding happening again at this location is statistically low.

### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

Denbighshire County Council and Natural Resources Wales are to carry out further investigation into the cause of the flooding and carry out measures to reduce flood risk if appropriate.

#### **2.2.11 Rhyl**

##### **Why did the flooding happen?**

Flooding affected two properties at Grange Road and a number of commercial properties at Clwyd Retail Park due to a period of exceptionally heavy rainfall.

#### **How likely it is for that scale of flooding to happen again?**

No detailed information is available, however rain gauge data suggests that this was an extreme rainfall event, so the likelihood of this scale of flooding happening again at this location is statistically low.

#### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

Denbighshire County Council has commissioned a study to review flood risk and Grange Road and to make recommendations for improvement works. At Clwyd Retail Park, regular inspections of the surface water drainage system and receiving watercourses should take place to ensure that the system is able to operate as intended.

#### **2.2.12 St Asaph**

##### **Why did the flooding happen?**

Three properties flooded at Llys y Felin due to the surcharge of a Welsh Water sewer. The sewer was unable to discharge properly to the River Elwy because of high water levels in the main river during the extreme rainfall event.

##### **How likely it is for that scale of flooding to happen again?**

The surcharge risk only occurs when the River Elwy is in spate, which won't always coincide with heavy rainfall conditions in the catchment that feeds the Welsh Water sewer. Therefore, it is difficult to accurately determine the likelihood of flooding happening again.

##### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

Denbighshire County Council and Welsh Water are working collaboratively to investigate a proposal which will reduce the likelihood of surface water entering properties.

#### **2.2.13 Prion**

##### **Why did the flooding happen?**

A single property was flooded during due to a combination of surface water and groundwater during a period of extremely heavy rainfall.



### **How likely it is for that scale of flooding to happen again?**

No detailed information is available, however rain gauge data suggests that this was an extreme rainfall event, so the likelihood of this scale of flooding happening again at this location is statistically low.

### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

Denbighshire County Council should carry out further investigation of the highway drainage system at this location and identify possible improvements.

#### **2.2.14 Llanrhaeadr**

### **Why did the flooding happen?**

Two properties were flooded due to surface water from the public highway during a period of extremely heavy rainfall.

### **How likely it is for that scale of flooding to happen again?**

Highway drainage systems are designed to deal with heavy rainfall, but there will always be a possibility that they will be overwhelmed during an extreme rainfall event.

### **What improvement actions are needed to ensure flood risk in the County is appropriately managed in future?**

Denbighshire County Council should carry out further investigation of the highway drainage system at this location and identify possible improvements.

### 3 Summary of Recommendations

#### Ruthin

Recommendation 1.1 - Review performance of the Ruthin flood alleviation scheme using the new survey data to update the existing flood hydrological model for Ruthin. This will also allow a look at the impacts of climate change.

Recommendation 1.2 – Use the new survey information of defence crest levels to check current flood warning thresholds / trigger levels.

Recommendation 1.3 – If required, following the modelling, Natural Resources Wales should undertake an initial assessment to identify ways to further reduce the risk of flooding through Ruthin and/or improve the standard of protection of flooding from the River Clwyd

Recommendation 1.4 - Natural Resources Wales and DCC to work together to improve community engagement, giving consideration to a possible Community Flood Plan, and the establishment of a Flood Partnership Group.

Recommendation 1.5 – Natural Resources Wales to consider developing a flood forecasting model for Ruthin.

#### Brookhouse, Denbigh

The Flood Investigation Report carried out following flooding on 9th Feb 2020 made several proposals. To date no progress has been made in considering/actioning these. Natural Resources Wales' 2021 addendum report does not propose additional actions to those recommended in 2020, but the following observations are made:

**09/02/2020 Proposal: “NRW to consider the viability of the implementation of a river level monitoring site on the Afon Ystrad to assist in earlier warning issued to residents.”**

- Consideration of the ability to provide improved warning and informing to residents, allowing additional time to prepare for flooding, could provide significant betterment at this location.

**09/02/2020 Proposal: “NRW to review the hydraulic modelling to take into account the findings of this 2020 flood investigation report.”**

- Whilst including up to date hydrological and topographical datasets will increase confidence in the understanding of risk to the community of Brookhouse, this will most likely confirm the existing understanding and mechanisms of flooding. Consideration of improved warning and informing services to the community may result in more timely provision of service improvements at this location.

## **Llandyrnog**

It is unlikely that formal flood defences would be cost effective to defend a small number of isolated properties, which already have individual property protection installed. Natural Resources Wales continues to have discussions with affected residents regarding measures that can be carried out to reduce the risk and impacts of flooding. In addition, the Council is in discussions with residents regarding possible improvements to highway drainage in the area.

## **Pentre Llanrhaeadr**

It might be possible to reduce flood risk by locally raising the height of the river bank adjacent to the first property referred to above. This work would require consent from Natural Resources Wales. It is also recommended that vegetation maintenance is considered, which might improve the capacity of the channel.

Carry out a survey of the river channel upstream and downstream of the flood location to check for any blockages / channel restrictions that may impact upon flow capacity.

Denbighshire County Council are to investigate possibility of carrying out a highway drainage improvement scheme to reduce the risk of surface water flooding.

## **Loggerheads**

Natural Resources Wales should work with Denbighshire County Council Countryside Services section to investigate possible measures to reduce flood risk during extreme rainfall events.

## **Llanarmon yn Iâl**

Natural Resources Wales should investigate whether improvement measures can be put in place to reduce flood risk during extreme rainfall events.

## **Corwen**

Natural Resources Wales should investigate whether improvement measures can be put in place to reduce flood risk during extreme rainfall events.

## **Rhuddlan**

It is recommended that Natural Resources Wales investigates whether improvements can be made to the main river watercourse at Pont Robin to improve capacity during extreme rainfall events.

## **Bodelwyddan**

The drainage system in the area comprises a main river, ordinary watercourses and highway drainage. A solution to reduce flood risk is likely to be difficult to achieve, given

the complex interactions between the various systems during extreme rainfall events. Nevertheless, it is recommended that Natural Resources Wales and Denbighshire County Council work together with landowners to investigate whether improvements can be made.

### **Cyffylliog/Bontuchel**

Denbighshire County Council should investigate whether measures can be put in place to reduce the risk of a culvert blockage. The owner of the Cyffylliog property has been provided with advice regarding possible measures to reduce the likelihood and impacts of groundwater flooding.

### **Denbigh Green**

The highway gullies have been checked and cleaned. There are no recommended improvement actions at this location.

### **Dyserth**

Denbighshire County Council is in the process of developing a flood risk management scheme for Dyserth, which will reduce the likelihood of flooding during a similar rainfall event.

### **Gwyddelwern**

Denbighshire County Council will investigate whether improvements can be made to the highway drainage system to reduce the risk of flooding in future.

### **Llanfair Dyffryn Clwyd**

Denbighshire County Council commissioned a flood risk assessment and has included this location in a project to assess how a natural flood management approach can be used to manage and reduce flood risk.

### **Llangollen**

Denbighshire County Council will investigate whether improvements can be made to the highway drainage system to reduce the risk of flooding in future.

### **Nantglyn**

Denbighshire County Council has carried out a flood risk assessment and has secured Welsh Government grant funding to carry out repairs and improvements to the existing drainage infrastructure.

### **Prestatyn**

The property owner has carried out measures to reduce flood risk in future.

## **Meliden**

Denbighshire County Council and Natural Resources Wales are to carry out further investigation into the cause of the flooding and carry out measures to reduce flood risk if appropriate.

## **Rhyl**

Denbighshire County Council has commissioned a study to review flood risk and Grange Road and to make recommendations for improvement works. At Clwyd Retail Park, regular inspections of the surface water drainage system and receiving watercourses should take place to ensure that the system is able to operate as intended.

## **St Asaph**

Denbighshire County Council and Welsh Water are working collaboratively to investigate a proposal which will reduce the likelihood of surface water entering properties.

## **Prion**

Denbighshire County Council should carry out further investigation of the highway drainage system at this location and identify possible improvements.

## **Llanrhaeadr**

Denbighshire County Council should carry out further investigation of the highway drainage system at this location and identify possible improvements.